

# Notes on Breeding the Marbled White Butterfly: *Melanargia galathea* L. ab. *craskei* Tubbs

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I am indebted to Mr. Robert Craske for giving Ralph Tubbs and myself the opportunity to breed this recently discovered aberration of the Marbled White butterfly (*M. galathea*), which has on the forewings the black markings around the central costal blotch extended outwards along the costa, joining the sub-apical bar, and extending distally to become confluent with the marginal markings. On the hindwings the black central band is broader than in the typical *galathea*. The upper and undersides of both sexes are affected. Mr. Tubbs has now named this aberration *craskei*.

Mr. Craske has observed this form annually in two restricted areas on the South Downs, since 1970. In the wild the ratio of aberrant forms to typical varies from 1 in 20 to 1 in 50.

Mr. Craske kindly gave two living females of this aberration to Ralph Tubbs in July 1974, which laid a total of 180 eggs, 30 of which were sent on to me. I kept these eggs in a small plastic container until they began to hatch, whereon I put the small larvae and the remaining unhatched eggs onto potted grass, and netted them over. The pot stood in a bowl of water which acts as a moat to keep out predators, such as beetles and earwigs, as well as providing sustenance for the grass. The pot was placed in my garden, and left there even in the worst weather.

The larvae of *galathea* remain very small until the spring, however they do feed a little in the milder spells during the winter, and at the end of December 1974, I examined a pot one evening, by torch light, and found a number of the larva crawling up the grass blades and feeding a little, they were about 3 mm long. When disturbed the larva falls to the ground, rolling into a compact ring.

In the spring of 1975 I found 11 healthy looking larvae, which I moved to a fresh crop of grass in a new pot, but some weeks later whilst checking that all was well, I accidentally squashed one, however the remaining 10 all pupated safely. The fully grown larva, when ready to pupate, just lies on the soil surface, making no kind of cocoon. After about four days it changes to pupa, remaining in pupa state for about three weeks, and during the final two or three days the forewing patterns can be seen through the pupa case.

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### Explanation of Plate

The top four show the normal heterozygote form of ab. *craskei* (Tubbs) male and female upper and undersides.

The middle four show the extreme homozygote forms, the two males on the left were bred 1979, the females on the right bred 1976.

The bottom two females are considered to be less extreme homozygotes. They also have twin apical spots. Bred 1979.

Photo by R. Revels.

The  $F_1$  generation began to hatch at the end of June 1975, and consisted of one crippled type male, three male abs., four typical females and two female aberrations. I decided to try to get pairings between the abs., and I put the three male abs. with the first female ab. to hatch, and although no pairing was seen, she began to lay a few days later stock *code* 75/A. The males were then put with the other female abs. Again no pairing was seen, but after four days she began to lay, stock *code* 75/B. I then took these rather old males and put them with one of the typical females, which after a few days laid about 20 eggs. *Code* 75/C.

The eggs from stocks 75/B and 75/C all collapsed after a few days, however the eggs from the 75/A stock proved to be fertile, this female had done well, laying almost 200 eggs. I sent 50 of these back to Mr. Tubbs who had only managed to breed one specimen from his stock, an aberrant female, which he kept for his collection.

I received back from Mr. Tubbs 30 eggs which had been laid by another wild female aberration given to him by Mr. Craske. Stock 75/D.

I collect the rather large white eggs up each evening by touching them with a wetted artist's paint brush, to which they adhere. The eggs were not attached to anything, being loose at the bottom of my laying cage. As before, I kept the eggs in a small plastic container until they began to hatch.

I decided to split this years stock up into three lots of about 50, to each pot of grass. In October 1975 I examined the pots and found fair numbers in two, but in the other one I could only find one larva. No predator could be found, and it remains uncertain what happened to the larvae in this pot. I decided to put some of the larvae from the two pots into a wooden cake which I had planted with grass. The two pots and the cage were kept outdoors, exposed to all weather throughout the winter. On the first of January 1976 I measured several of the larvae, which were about 4 mm long, being slightly larger than at the same time the previous winter.

No significant difference in the survival rate was found between those overwintered in the cage (which had given them some protection from the rain and frosts) and those left in the pots; neither being very successful. In mid April I moved the larvae to fresh grass in new pots, but I could only find 12 larvae, 11 of which reached pupa. At the end of June 1976 stock 75/A produced an  $F_2$  generation of one typical male, three male abs., two typical females and five female aberrations. One of the males abs. and four of the female abs. were more extreme than had been seen before, either in the wild by Mr. Craske, or in the broods that had been bred. Mr. Tubbs also had some of these extreme forms in the brood that he reared from the eggs I had sent him.

From the results so far it seems likely that ab. *craskei* is produced by a "dominant" gene, with the usual form which had been taken in the wild by Mr. Craske, and bred in the  $F_1$

generations, being the heterozygote form; and the more extreme forms which hatched in the brood when an ab. male was paired with an ab. female, being the homozygote form. As some typical specimens hatched in this brood it rules out this form being a "simple recessive," as a pure strain of aberrations would have been produced.

From the 75/D stock I bred one typical male, two male abs. and three female abs. These, as expected, were normal ab. *craskei*.

I feared that further inbreeding between brother and sisters of stock 75/A was likely to produce a very weak strain, so I decided to try for a pairing between a heterozygote male from 75/D stock, and an extreme homozygote female ab. from 75/A stock. A pairing was seen, but I only had about 50 eggs laid by the female before she succumbed to the heat of that summer and died. *Stock 76/A*.

I obtained another pairing between the other heterozygote male from 75/D, and a typical female from 75/A. About 45 eggs were laid by this female before she died. *Stock 76/B*.

The intense heat of the 1975 and 1976 summers proved to be a nuisance, and my laying cages had to be kept out of the full force of the sun, yet some sun is required to get the butterflies to mate and lay. Fortunately I have two peach trees in my garden which let through dappled sunlight, so my laying cages were placed under these trees. I also kept them cool by spraying them with water several times a day when it was very hot. The insects obviously liked these showers, as they would drink readily from the water droplets on the netting and flowers.

In July 1977 stock 76/A produced two male abs. and two female abs. This stock should have produced both heterozygotes and homozygotes, but the four I did manage to rear were rather intermediate in appearance between the two forms. Stock 76/B did not produce any butterflies, one reached pupa but did not hatch.

I decided to out cross the aberrations from 76/A, with wild typical stock from the Chiltern hills, in the hope that it would strengthen this weak and difficult strain. On my visit to the Chilterns to get males to put with the two bred female abs., I was fortunate to find a freshly emerged typical female which had not fully expanded its wings, and was presumably still a virgin. She was boxed and taken home.

Pairings were seen between the bred female aberrations and the typical wild males, code 77/A and 77/B. These laid between 60 and 70 eggs each. I did not see a pairing between the wild female and one of my bred males abs., however about 60 eggs were laid which proved to be fertile, code 77/C.

In July 1978 I had the following hatch: (1) *Stock 77/A*. One male ab. and one female ab. (2) *Stock 77/B*. One male ab. (3) *Stock 77/C*. Three males abs. and eight female abs.

The 77/A and 77/B stocks were very weak despite introducing wild blood into the stock. The 77/C stock was rather

stronger, and as all 11 specimens which hatched were aberrations it seems reasonable to assume that the male parent was in fact the homozygote form. I attempted to get four pairings from the above, as follows: (1) *Stock 78/A*. Male and female abs. from 77/C. Pairing seen and about 130 eggs were laid. I sent 50 on to Mr. Tubbs. (2) *Stock 78/B*. Male ab. from 77/A, female ab. from 77/C. Pairing seen but all the eggs were infertile. (3) *Stock 78/C*. Male ab. from 77/B, female ab. from 77/C. No pairings seen and what eggs were laid collapsed. (4.) *Stock 78/D*. Male and female abs. from stock 77/C. Pairing seen and about 130 eggs laid 30 of which I sent to Mr. Tubbs.

Both "A" and "D" stocks survived the winter better than my previous broods, however I continued to have fatalities during the spring, and some even died after changing to pupa. I sent several of the dead larvae and pupae to the Unit of Invertebrate Virology at Oxford, to see if a virus was responsible, however they could not detect any, although bacteria were present.

In July 1979 stock 78/A produced four type males, nine ab. males, no type females and 11 aberrant females. Stock 78/D produced five type males, seven male abs., four type females and 13 female abs.

The two stocks added together gave me 13 type, 26 which I classed as being the heterozygote form, and 14 being the more extreme homozygotes. This gave me 25%, 50%, 25%, a result in line with ab. *craskei* being dominant to type. About three-quarters of the insects which hatched in these broods had twin apical spots on their forewings, a form which I have not bred before. This gene was presumably introduced with the wild stock from the Chilterns in 1977, where this form is not uncommon.

I attempted, but failed, to get a pairing between two of the homozygotes, the weather at that time was very poor, with only brief spells of sunshine, giving little chance of a pairing.

The results Ralph Tubbs obtained from his broods were roughly in line with mine, with neither of us achieving great success. This aberrant train seems to be rather weak, and the long period that the larva remain small, leaves them very vulnerable to even the smallest predator. These I think are the main reasons for the disappointing numbers reared in most broods.

The homozygote form is best described as having the *craskei* character intensified. The black central costal blotch on the forewing is larger, extending in a solid block to the marginal markings in the more extreme specimens, however this is not always achieved. On the underside of the forewings the black and grey area is larger and extends further along the costal margin. On the hindwings the black central band is considerably broader than in the heterozygotes. As there is considerable variation in both forms, it is not always easy to segregate between a good heterozygote and a poor homozygote. This is particularly so with the males.